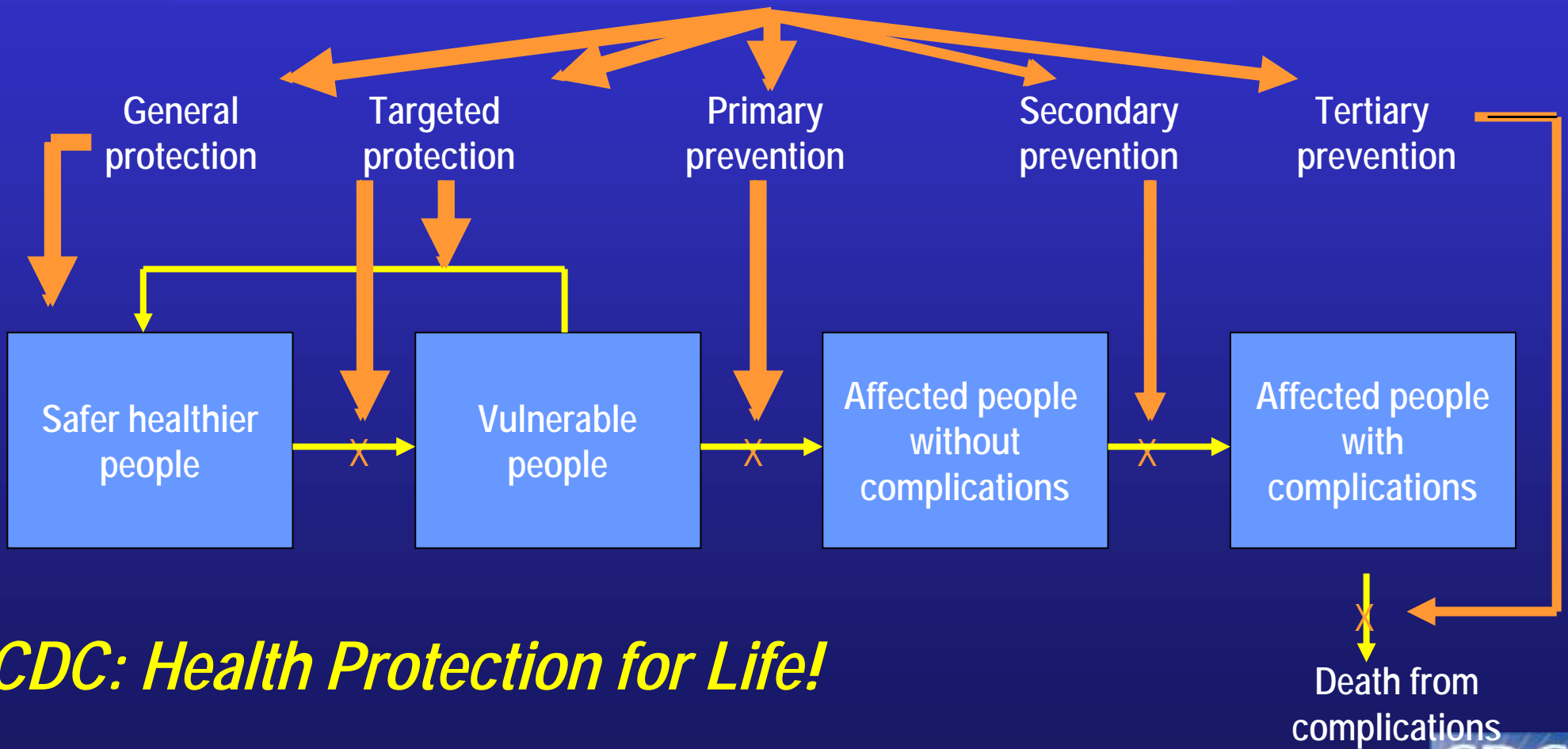




# Health Protection in the 21<sup>st</sup> Century: Exploiting “Small World” Networks *[www.cdc.gov](http://www.cdc.gov)*



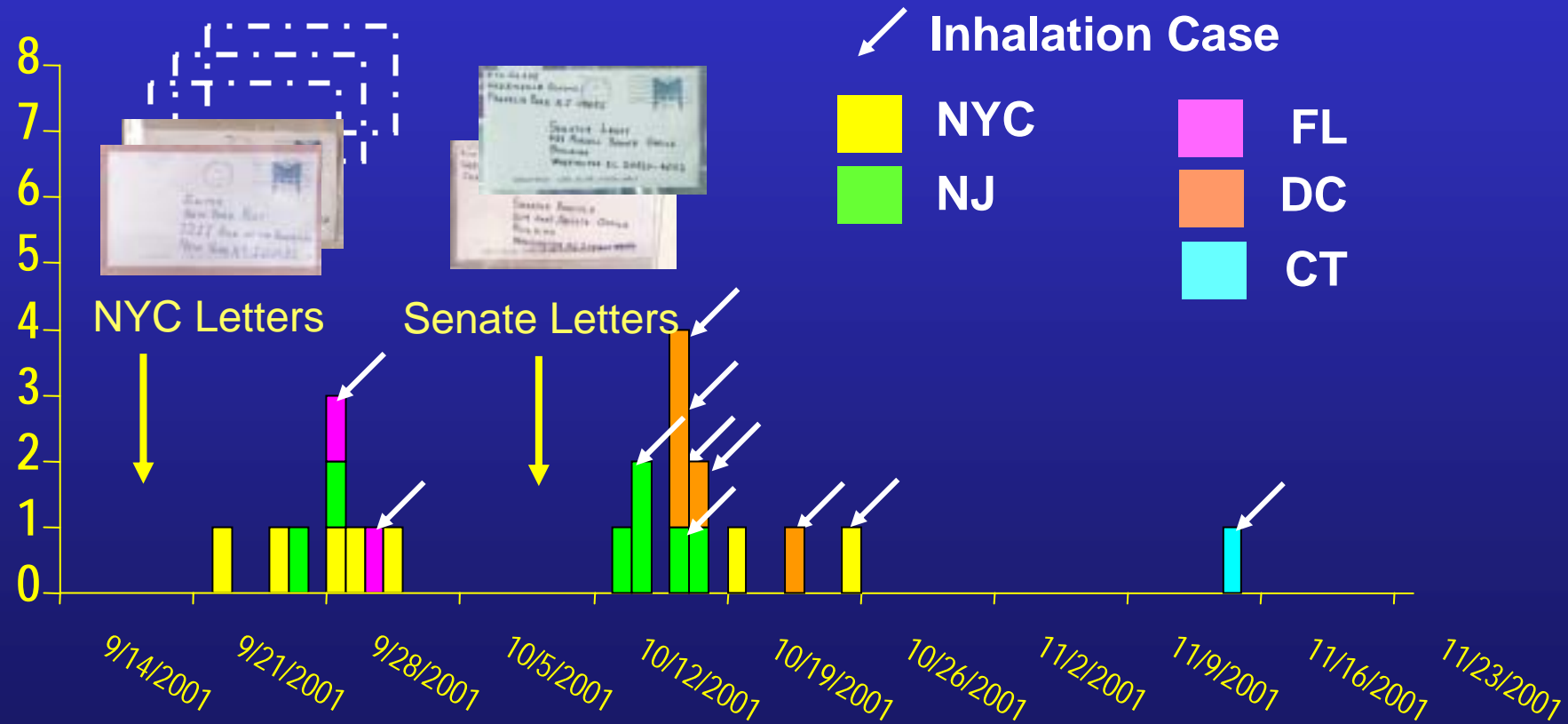
# *Future Health Priorities*



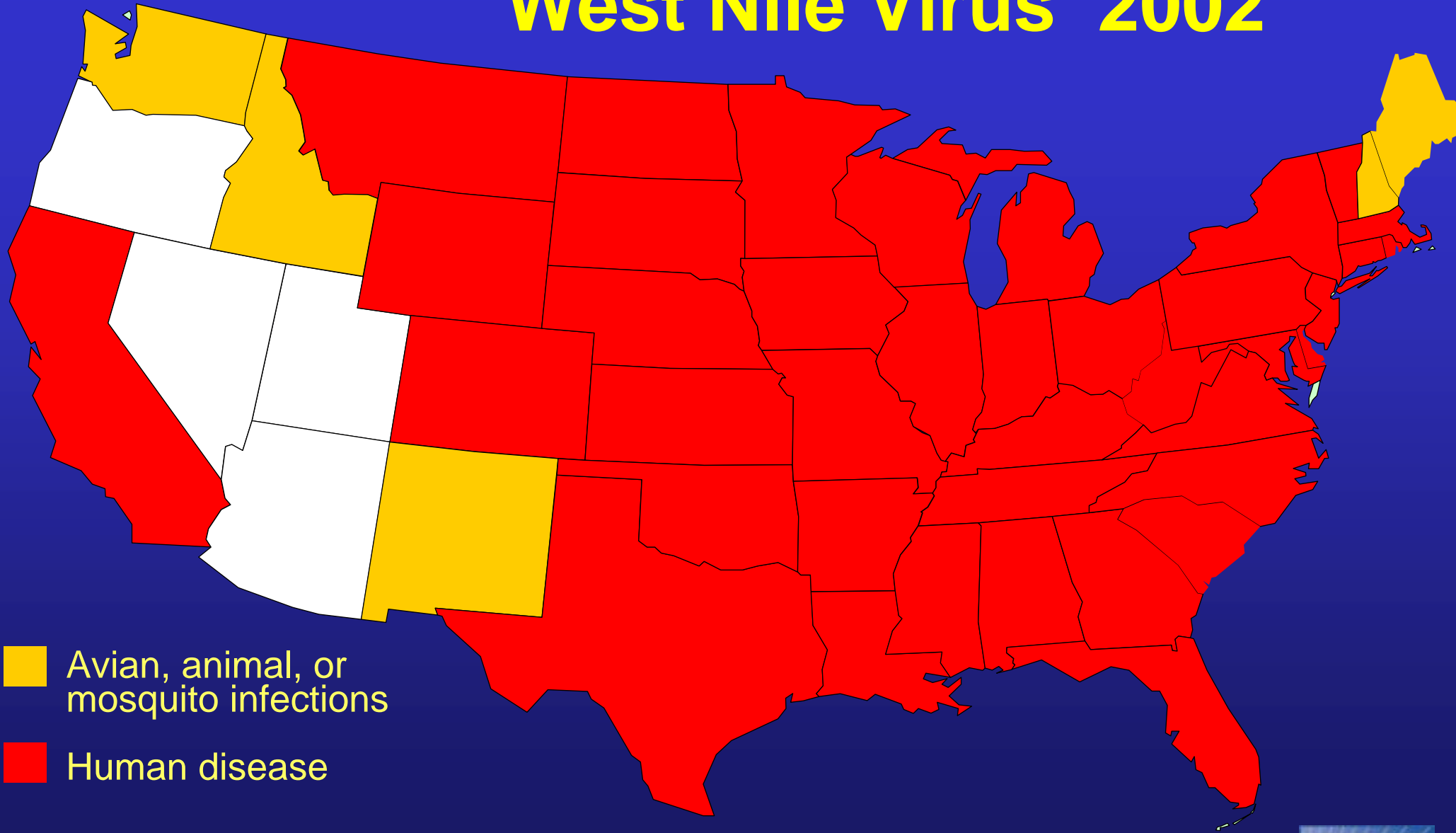
***CDC: Health Protection for Life!***



# Bioterrorism-related Anthrax Cases



# West Nile Virus 2002

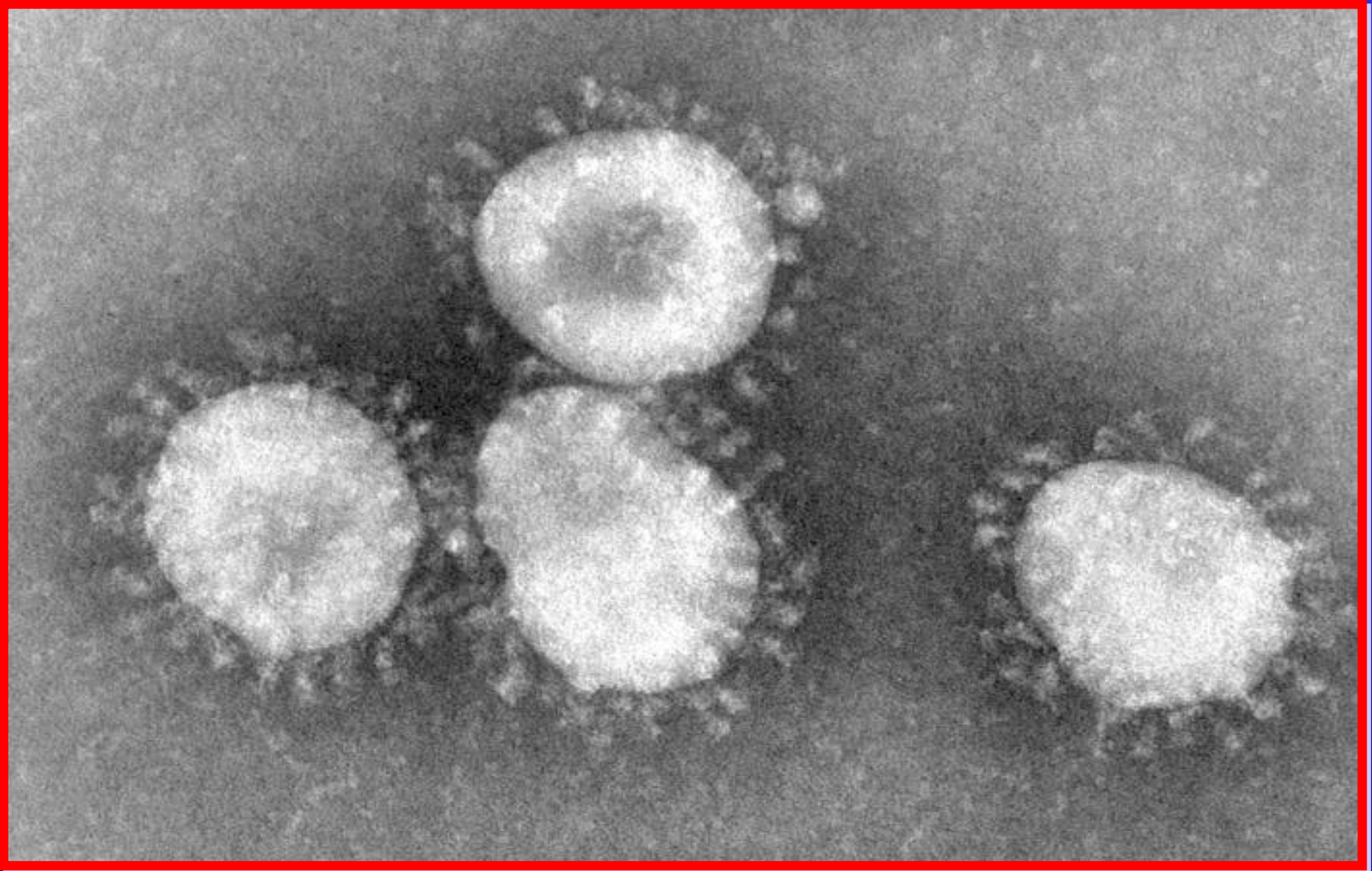


Yellow: Avian, animal, or mosquito infections

Red: Human disease









# West Nile Virus 2003

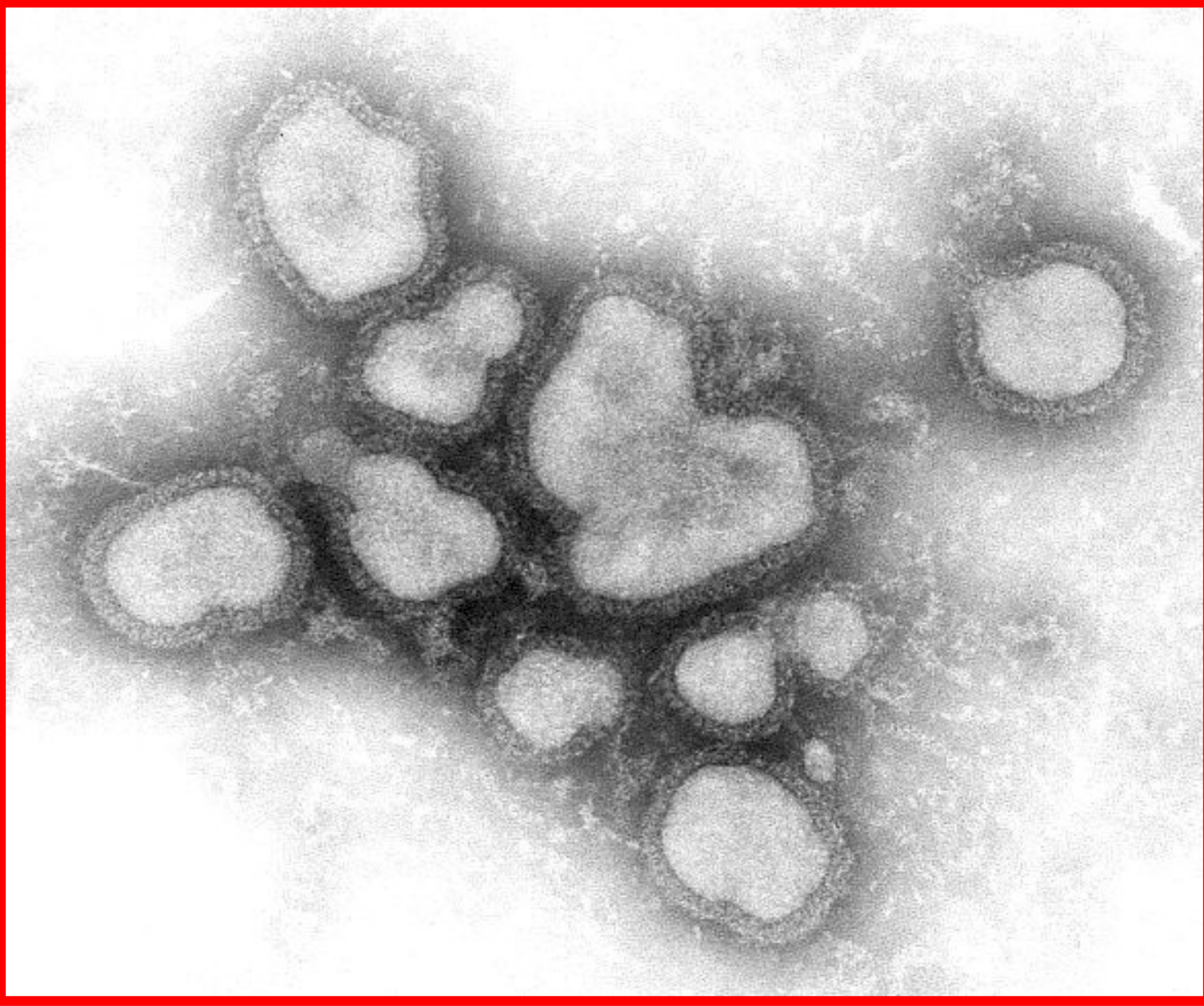


Avian, animal, or mosquito infections

Human disease









(AP PHOTO)

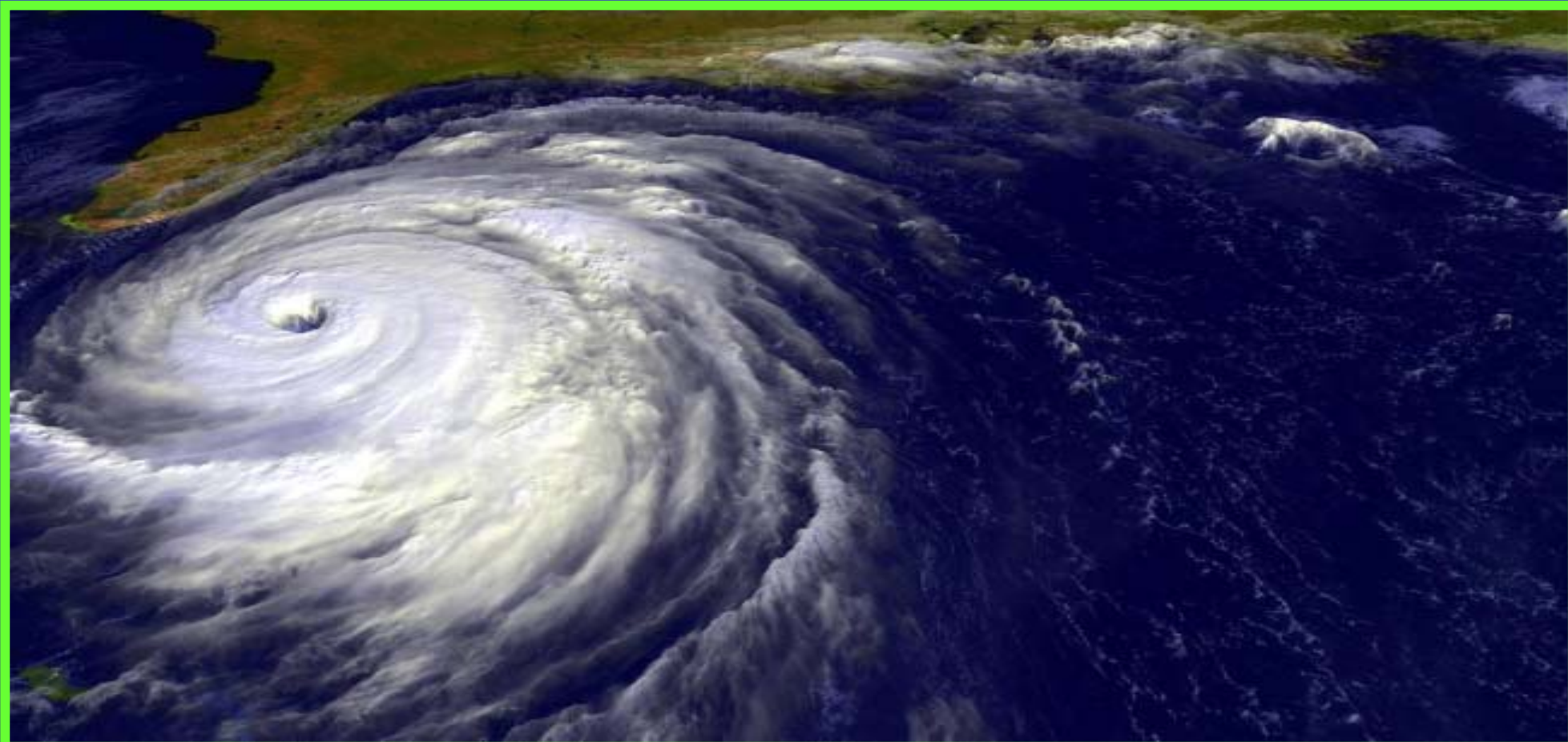


# Flu Shots Over All Vaccine Used

Call Santa Clara County Health Dept. for  
other sites: 792-5200







# Tsunami Relief Efforts

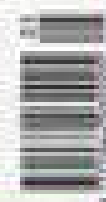


# TIME

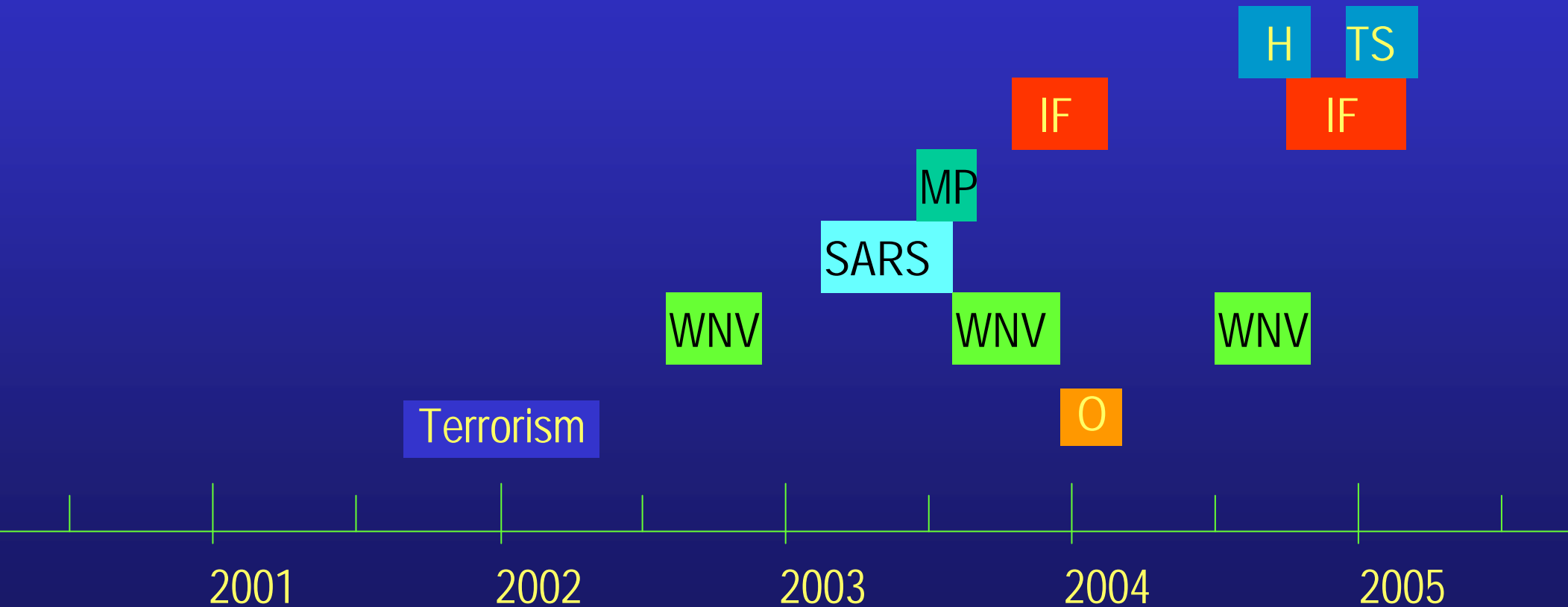


## BIRD FLU

Is Asia  
hatching  
the next human  
pandemic?

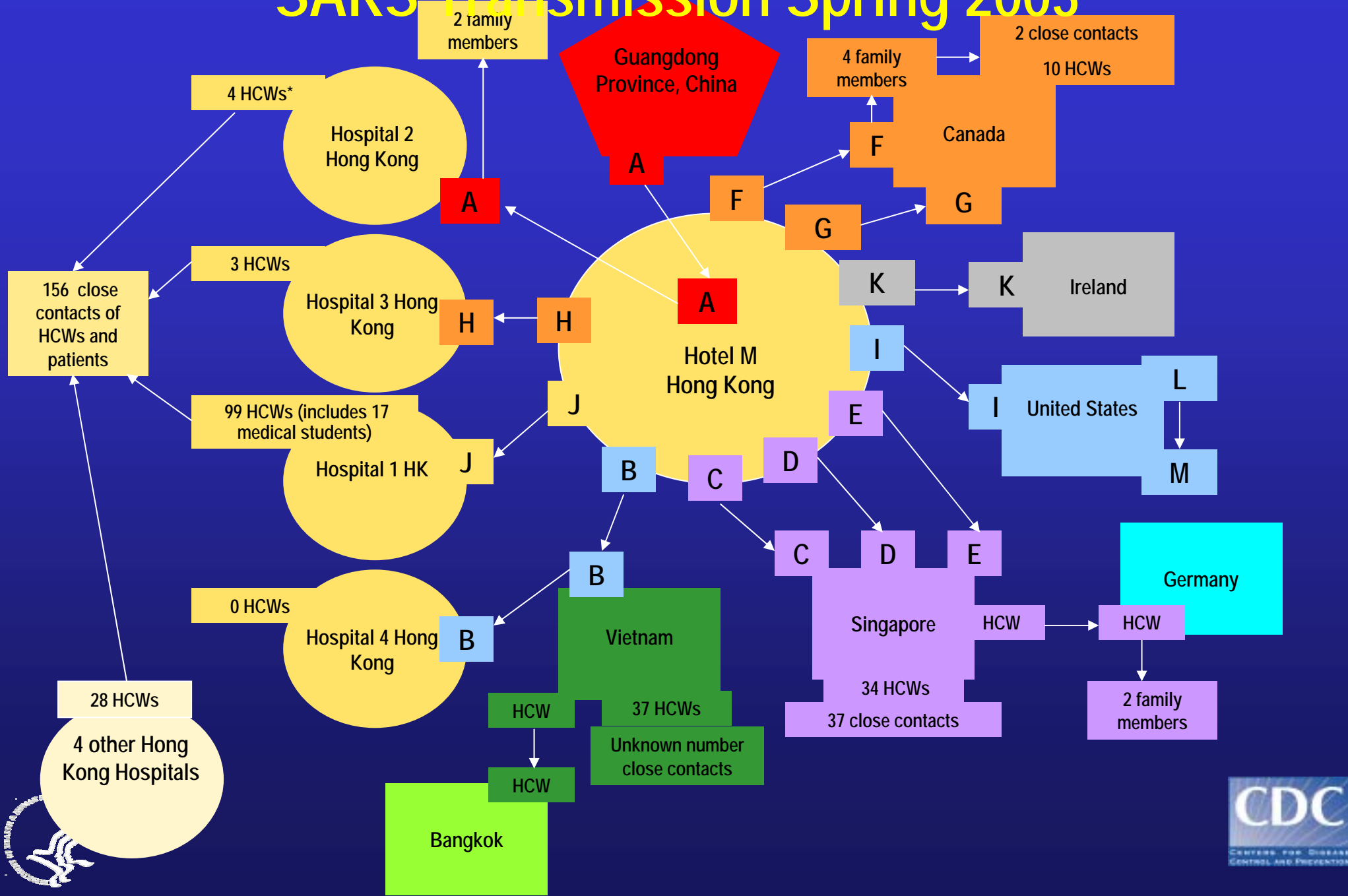


# CDC Emergency Operations: 9/11/01- 1/18/05





# SARS Transmission Spring 2003





*It's a small world network!*

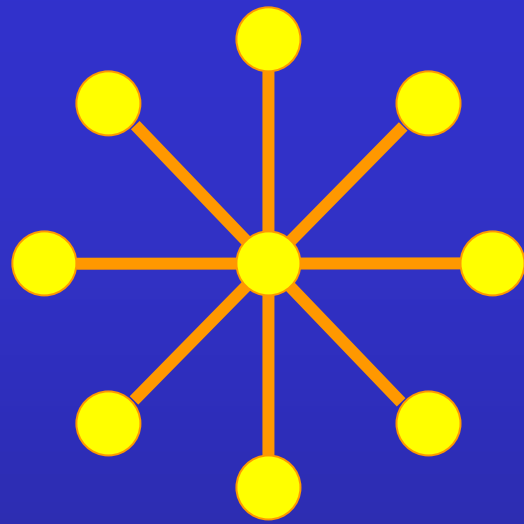


# Small World Networks

“I read somewhere that everybody on this planet is separated by only 6 other people. Six degrees of separation. Between us and everybody else on this planet...It’s a profound thought!” *Quise in Six Degrees of Separation by John Guare*

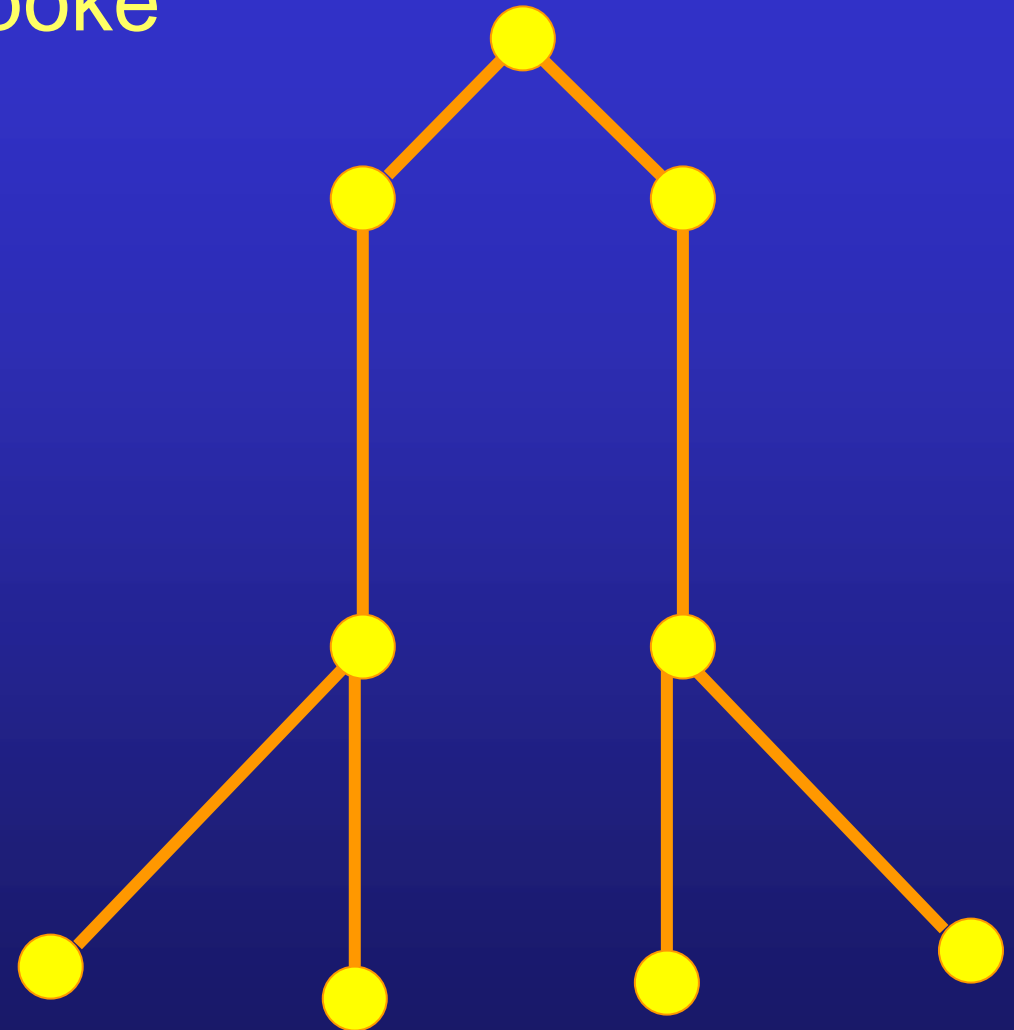
“The world is small...any one person can be reached through networks of friends in only a few steps.”  
*Stanley Milgram*



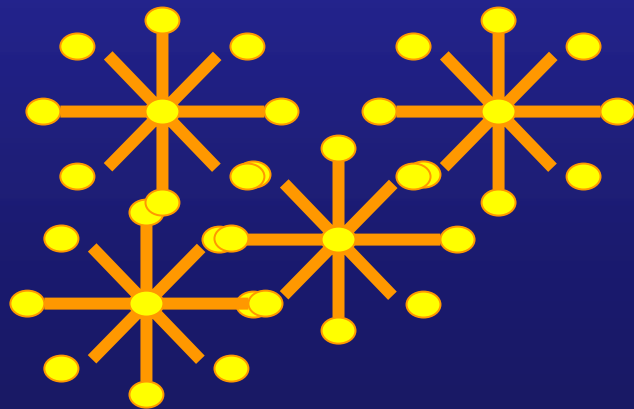


Hub and Spoke

Hierarchy



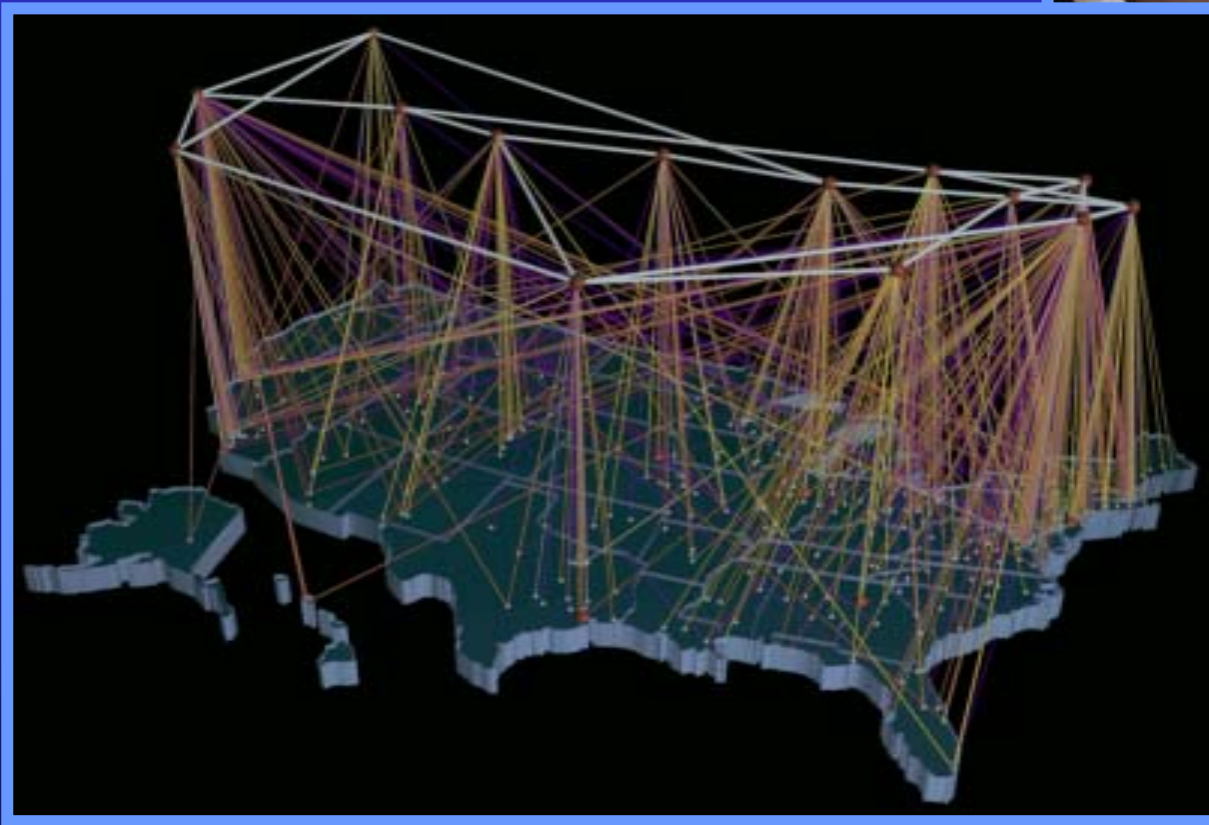
Multi-Hub and Spoke



*Denning: Network Laws. Communications of the ACM 47:15-20, 2004*



# Cyberspace



## Internet



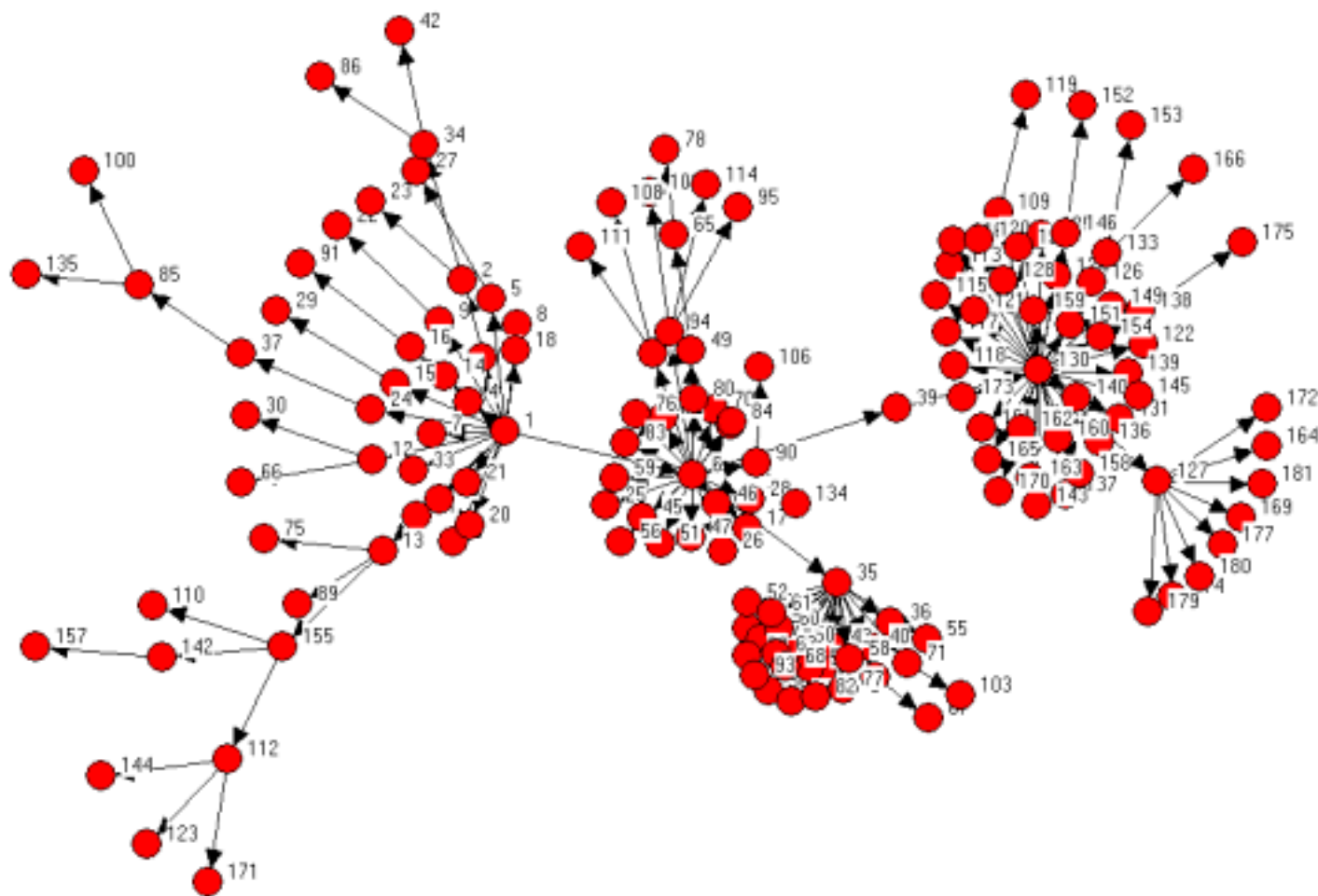


*Weak tie...Strong Link!*



# SARS Transmission in Singapore

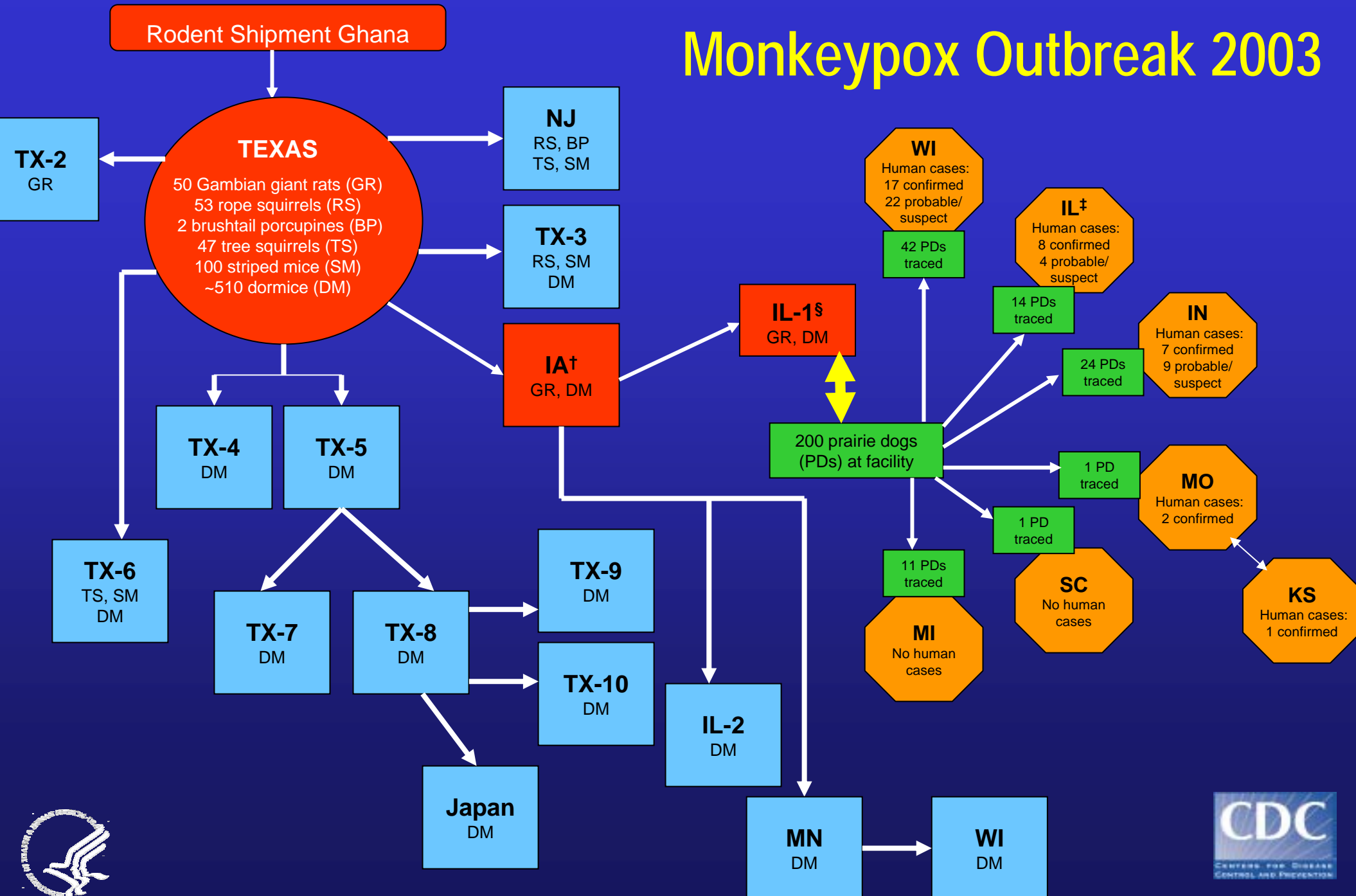
February 25 – April 30, 2003



Bogatti SP. Reprinted in MMWR 5-9-03

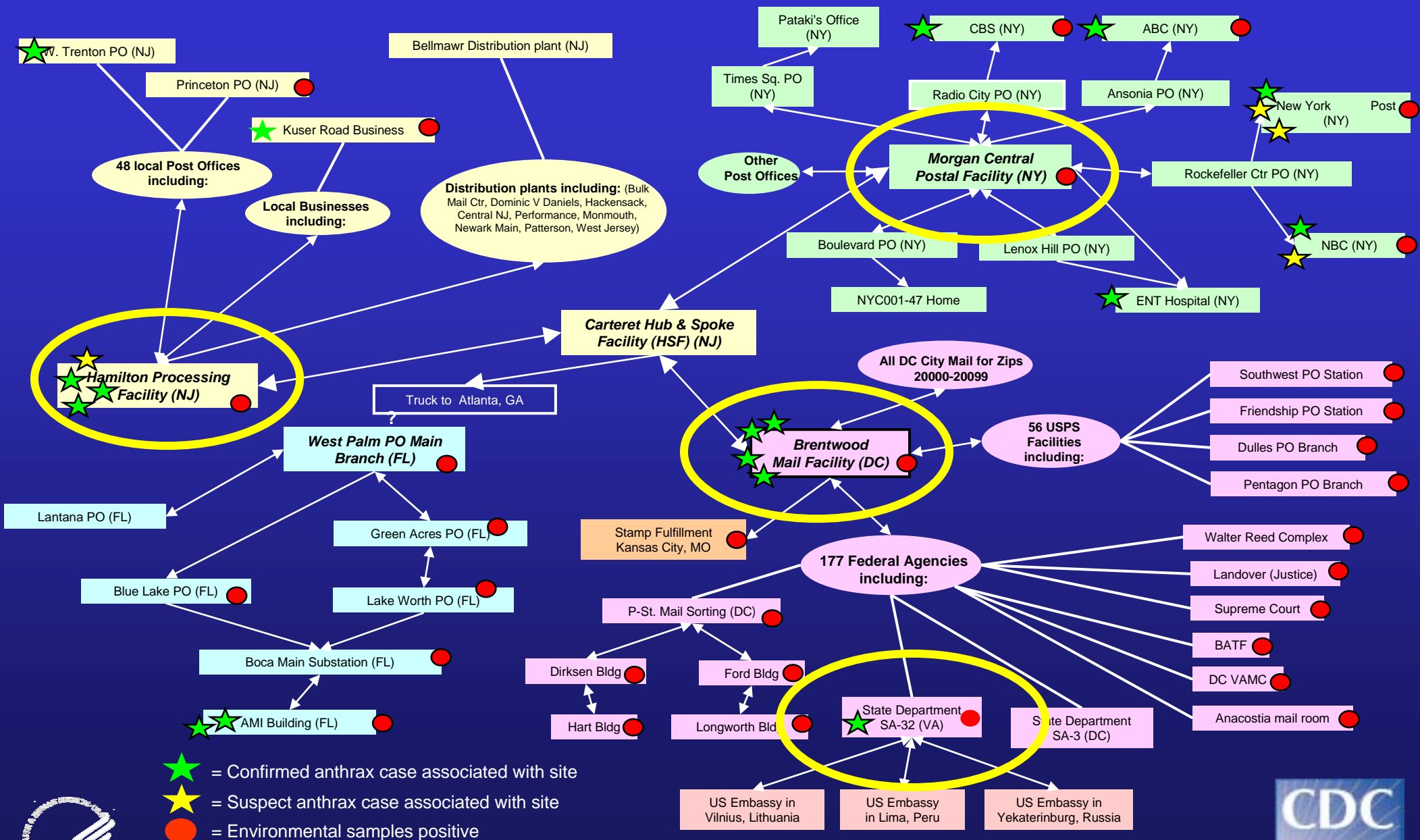


# Monkeypox Outbreak 2003





# Anthrax Attack 2001: Mail Flow Network...



November 7, 2001





# Protecting People in a Small World

## Threat Characteristics

- Global threats with local impact; local threats with global impact
  - Health
  - Security
  - Economy
- Small world networks
  - Zoonoses / Vectors
  - Speedy transmission

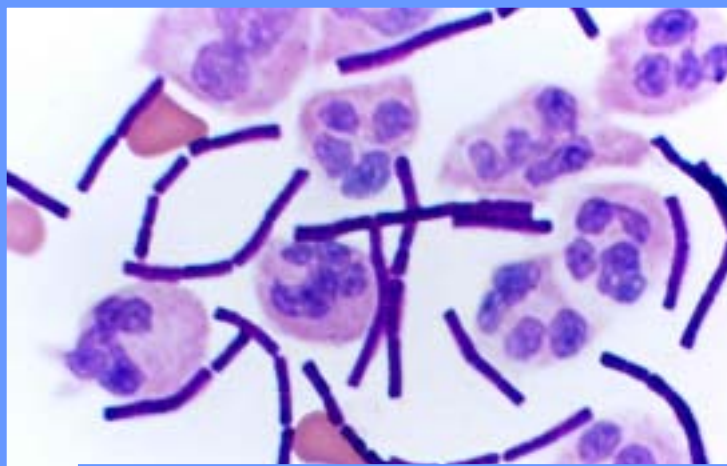
## Preparedness Network Requirements

- Fast detection
- Fast science
- Fast & effective communication
- Fast & effective integration
- Fast & effective action!

*Globalization, connectivity, and speed*



# Small World Networks: Fast Detection and Response - Clinicians



## Public Health Dispatch

### **West Nile Virus Infection in Organ Donor and Transplant Recipients — Georgia and Florida, 2002**

On August 23, 2002, the Georgia Division of Public Health

ained from  
ess in





# Small World Networks: Fast Detection and Response...Veterinarians

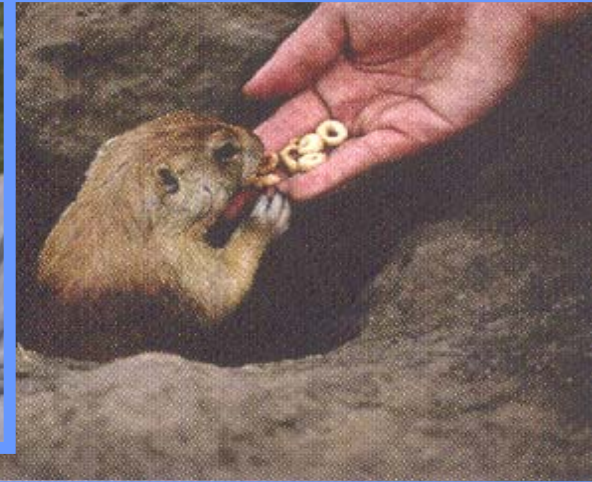
Science 2003;301:1031.



USGS



BMJ 2003;326:1350.



TFAH. Aug 2003



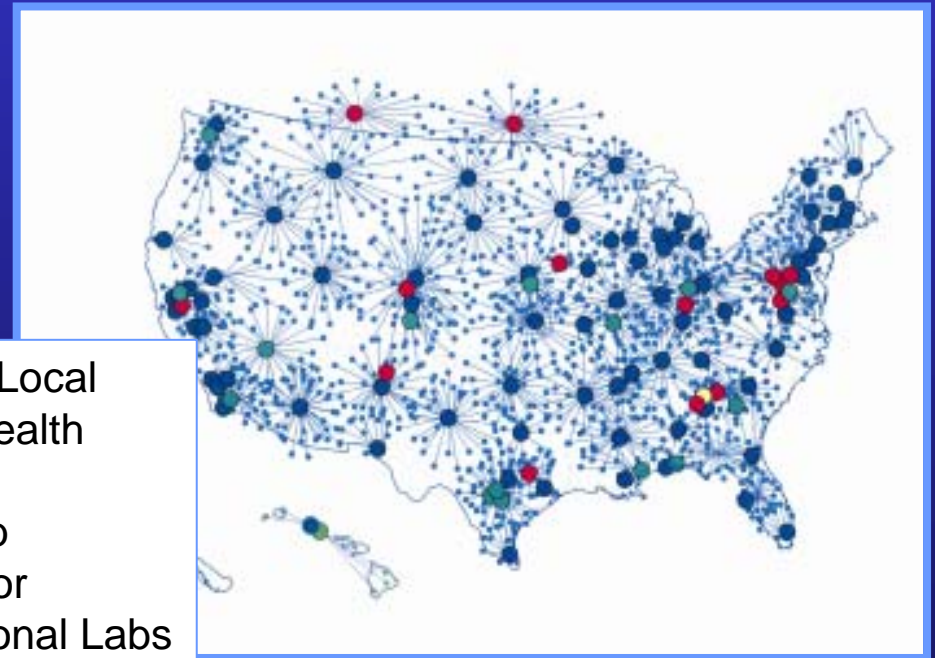
# Small World Networks: Fast Detection and Response - Laboratorians

## CDC's Laboratory Response Network

September 2001



September 2004



- State or Local Public Health Labs
- CDC Lab
- Federal or International Labs
- Military Labs
- Conceptualized Connections to Sentinel



# Small World Networks: Fast Detection and Response

## Creating Strong Links!

Bioterrorism-Related Anthrax:  
Collaboration Between Public Health  
and Law Enforcement: New Paradigms  
and Partnerships for Bioterrorism Planning and  
Response

Jay C. Butler,\* Mitchell L. Cohen,\* Cindy R.  
Friedman,\* Robert M. Scripp,† and Craig G. Watz†

*\*Centers for Disease Control and Prevention,  
Atlanta, Georgia, USA; and †Federal Bureau of  
Investigation, Washington, D.C., USA*

### POLICY FORUM

PUBLIC HEALTH

#### Building Microbial Forensics as a Response to Bioterrorism

Bruce Budowle,<sup>1\*</sup> Steven E. Schutzer,<sup>2</sup> Anja Einseln,<sup>1</sup> Lynda C. Kelley,<sup>3</sup> Anne C. Walsh,<sup>4</sup>  
Jenifer A. L. Smith,<sup>1</sup> Babetta L. Marrone,<sup>5</sup> James Robertson,<sup>1</sup> Joseph Campos<sup>6</sup>





## Small World Networks: Fast Science

# WHO Collaborative Network for SARS





# Small World Networks: Fast Science

**Science magazine** HELP SUBSCRIPTIONS FEEDBACK SIGN IN AAAS  
SEARCH BROWSE ORDER THIS ARTICLE

Originally published in Science Express as 10.1126/science.1085952 on May 1, 2003  
Science, Vol. 300, Issue 5624, 1394-1399, May 30, 2003

## Characterization of a Novel Respiratory Syndrome

Paul A. Rota,<sup>1,2</sup> M. Steven Oberste,<sup>1</sup>  
Silvia Peñaranda,<sup>1</sup> Bettina Hankamp,<sup>1</sup>  
Luis Lowe,<sup>1</sup> Michael Frace,<sup>1</sup> Joseph  
Cara Burns,<sup>1</sup> Thomas G. Ksiazek,<sup>1</sup> P  
Josef Limor,<sup>1</sup> Karen McCaustland,<sup>1</sup>  
Albert D. M. E. Osterhaus,<sup>3</sup> Christian

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## Articles

## Coronavirus as a possible cause of severe acute respiratory syndrome

J S M Peiris, S T Lai, L L M Poon, Y Guan, L Y C Yam, W Lim, J Nicholls, W K S Yee, W W Yan, M T Cheung, V C C Cheng, K H Chan, D N C Tsang, R W H Yung, T K Ng, K Y Yuen, and members of the SARS study group\*

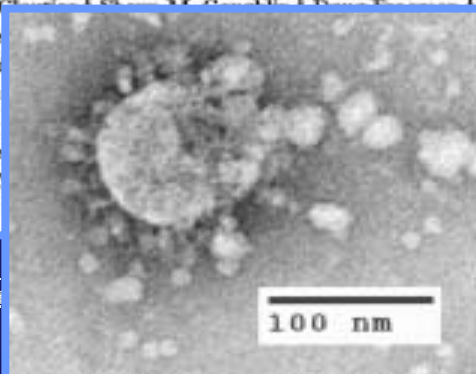
## JOURNAL of MEDICINE

**Science magazine** HELP SUBSCRIPTIONS FEEDBACK SIGN IN AAAS  
SEARCH BROWSE ORDER THIS ARTICLE

Originally published in Science Express as 10.1126/science.1085953 on May 1, 2003  
Science, Vol. 300, Issue 5624, 1399-1404, May 30, 2003

## The Genome Sequence of the SARS-Associated Coronavirus

Marco A. Marra,<sup>1,2</sup> Steven J. M. Jones,<sup>1</sup> Caroline R. Astell,<sup>1</sup> Robert A. Holt,<sup>1</sup> Angela Brooks,<sup>1</sup>  
Aaron S. N. Butterfield,<sup>1</sup> Jasvinder Khattra,<sup>1</sup> Jennifer K. Asano,<sup>1</sup> Sarah A. Barber,<sup>1</sup> Susanna Y  
Eason,<sup>1</sup> Stephen J. M. Jones,<sup>1</sup> M. Steven Oberste,<sup>1</sup> Noreen Ginn,<sup>1</sup> Obi L. Griffith,<sup>1</sup> Stephen  
Mery,<sup>1</sup> Pawan K. Pandoh,<sup>1</sup> Anca S. Petr  
Squ,<sup>1</sup> Doreen E. Smolke,<sup>1</sup> Jeff M. Stoe  
athalie Ba  
Fernando  
mann,<sup>2</sup> A  
am Tyler,  
nuta M. S



## Identification of a Novel Coronavirus in Patients with Severe Acute Respiratory Syndrome

Christian Drosten, M.D., Stephan Günther, M.D., Wolfgang Preiser, M.D.,  
Sylvie van der Werf, Ph.D., Hans-Reinhard Brodt, M.D., Stephan Becker, Ph.D.,  
Holger Rabenau, Ph.D., Marcus Panning, M.D., Larissa Kolesnikova, Ph.D.,  
Ron A.M. Fouchier, Ph.D., Annemarie Berger, Ph.D., Ana-Maria Burguière, Ph.D.,  
Jindrich Cinatl, Ph.D., Markus Eickmann, Ph.D., Nicolas Escriou, Ph.D.,  
Klaus Grywna, M.Sc., Stefanie Kramme, M.D., Jean-Claude Manuguerra, Ph.D.,  
Stefanie Müller, M.Sc., Volker Rickerts, M.D., Martin Stürmer, Ph.D., Simon Vieth,  
Hans-Dieter Klenk, M.D., Albert D.M.E. Osterhaus, Ph.D.,  
Herbert Schmitz, M.D., and Hans Wilhelm Doerr, M.D.

## A Novel Coronavirus Associated with Severe Acute Respiratory Syndrome

Thomas G. Ksiazek, D.V.M., Ph.D., Dean Endman, Dr.P.H., Cynthia S. Goldsmith, M.S., Sherif R. Zaki, M.D., Ph.D.,  
Teresa Peret, Ph.D., Shannon Emery, B.S., Susiang Tong, Ph.D., Carlo Urbani, M.D.,\* James A. Comer, Ph.D., M.P.H.,  
Wilna Lim, M.D., Pierre E. Rollin, M.D., Scott F. Dowell, M.D., M.P.H., Ai-Ee Ling, M.D., Charles D. Humphrey, Ph.D.,  
Wun-Ju Shieh, M.D., Ph.D., Jeannette Guarnier, M.D., Christopher D. Paddock, M.D., M.P.H.T.M., Paul Rota, Ph.D.,  
Barry Fields, Ph.D., Joseph DeRisi, Ph.D., Jyh-Yuan Yang, Ph.D., Nancy Cox, Ph.D., James M. Hughes, M.D.,  
James W. LeDuc, Ph.D., William J. Bellini, Ph.D., Larry J. Anderson, M.D., and the SARS Working Group†

# Small World Networks: Prediction and Prevention

## ASIA FIGHTS AN EPIDEMIC



SHAMUL ADE, / Associated Press

Alarm over the bird flu has risen at poultry farms such as this one near Karachi, Pakistan, as the country became the eighth to report a variant of the disease. A 6-year-old boy in Thailand marked the seventh recent fatality from bird flu.

## Killer bird flu rampant

Atlanta Journal Constitution

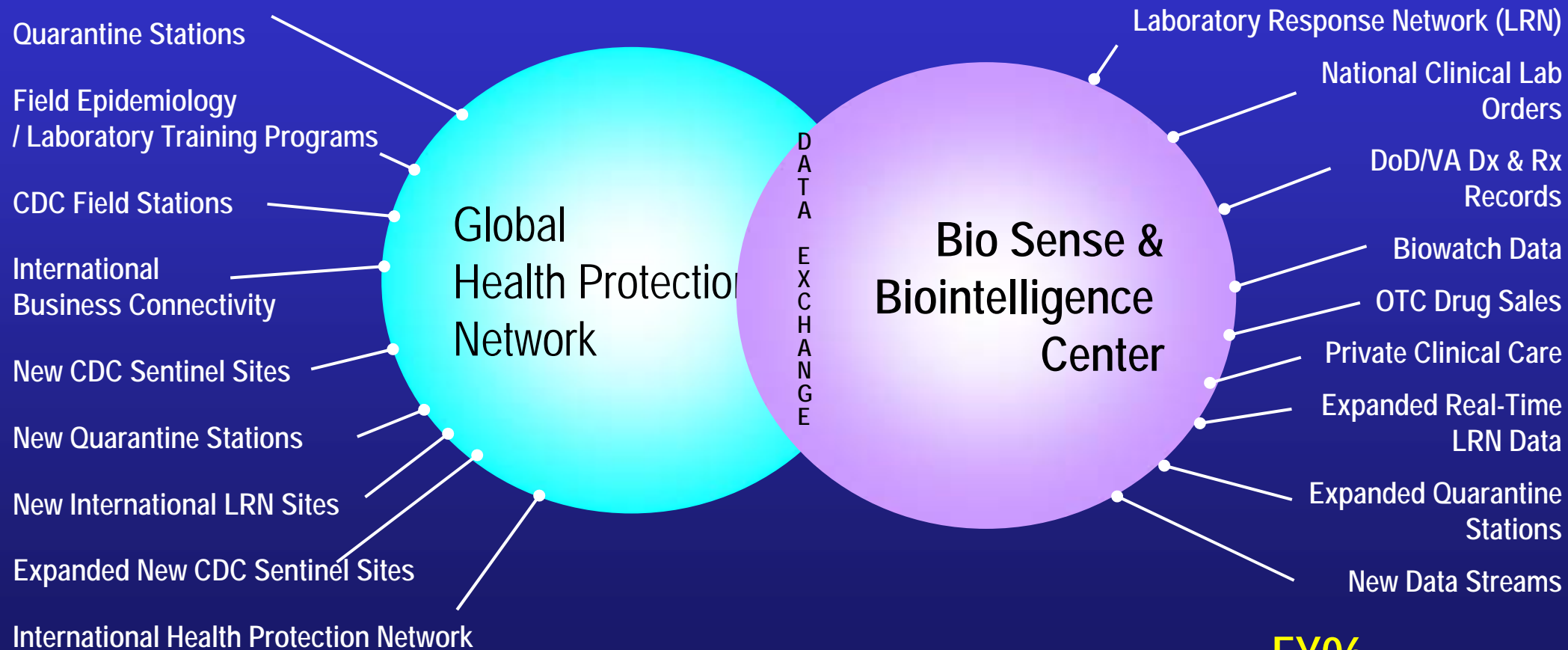


# Small World Networks: Fast Detection and Response

## CDC's International Health Protection Network

FY04

FY04



FY06





# Small World Networks: Fast Detection and Response

## Real-Time Tracking of Influenza 2004-05



**Household Survey:  
Vaccine Use**



**Long-term Care:  
Vaccine Needs Survey**



State	County	City	Population	Vaccine Type	Allocation
Alabama	Adams	Adams	1,234	Influenza	50
Alabama	Barbour	Barbour	2,345	Influenza	100
Alabama	Bibb	Bibb	3,456	Influenza	150
Alabama	Blount	Blount	4,567	Influenza	200
Alabama	Bolivar	Bolivar	5,678	Influenza	250
Alabama	Bullock	Bullock	6,789	Influenza	300
Alabama	Butler	Butler	7,890	Influenza	350
Alabama	Calhoun	Calhoun	8,901	Influenza	400
Alabama	Chambers	Chambers	9,012	Influenza	450
Alabama	Cherokee	Cherokee	10,123	Influenza	500

**State & Local Health  
Officials: Secure Vaccine  
Allocation Database**



**Laboratories: Virus  
Genetic Sequencing  
& Rapid H5 detection**



**Global Biodefense  
Network**



**BioSense:  
Influenza-like Illness  
Visits**

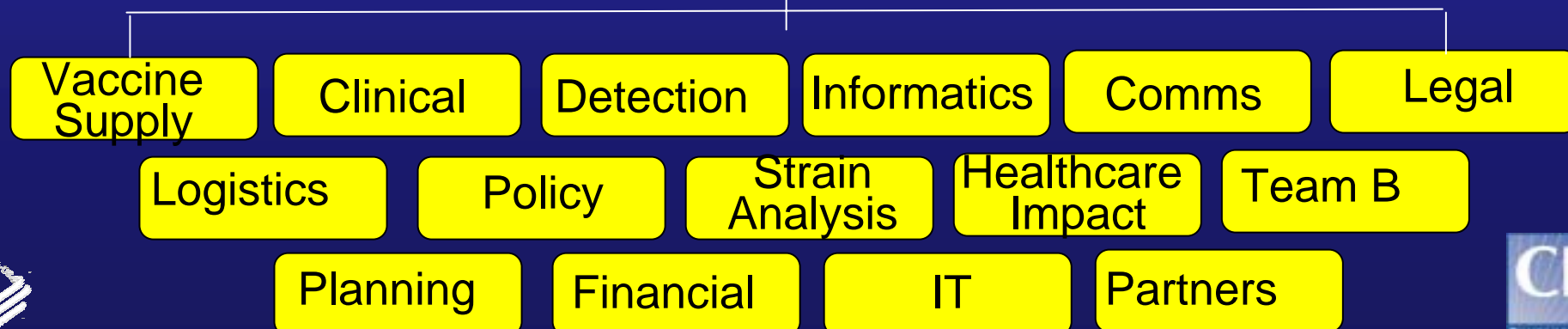


## Small World Networks: Fast Action

# Operation Influenza 2003-2004



### Coordinating Center Infectious Diseases



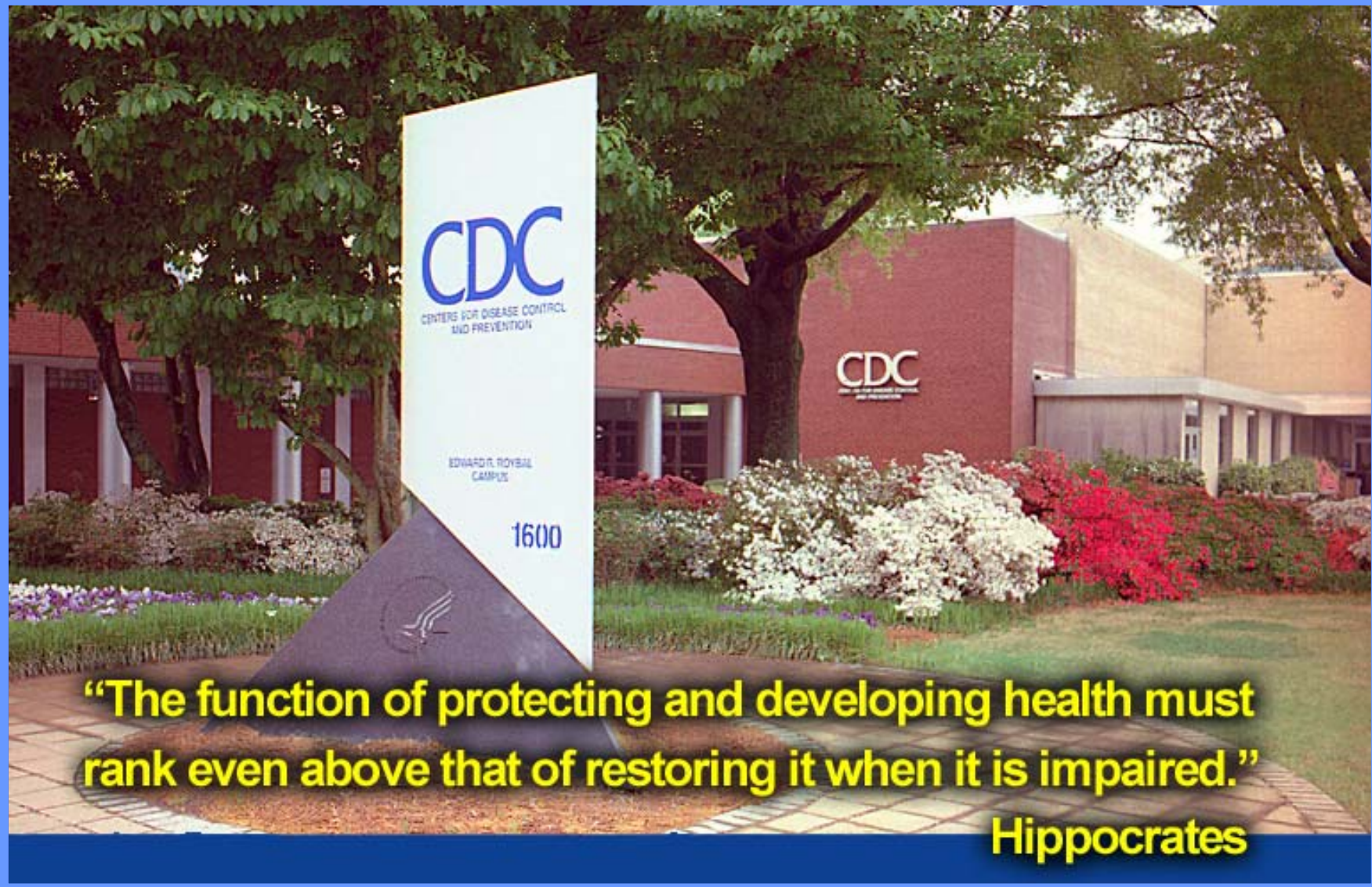
# A Small World Health Network for Health Protection



- Multisector integration
- Public-private
- Non-partisan
- Local - state – national
- Domestic – international
- Animal – Human - Plant







**[www.cdc.gov](http://www.cdc.gov)**

